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# Demountable ramps: A qualitative assessment of value for people with mobility impairments

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## Background

Ramps are one of the most common home modifications for improving the accessibility of people with mobility impairments. In New South Wales, almost a quarter (23%) of dwelling modifications for older people or people with a disability was access ramps or step-free entrances. Ramps are the third most commonly requested home modification following the installation of grab rails (74%), and changes to the layout of the toilet, bathroom or laundry (39%) (Australian Bureau of Statistics, 2004). Ramps are installed to facilitate the movement between levels of a person who uses a wheelchair or walker by eliminating the need to walk up or down steps. It has been well recognised that the use of ramps allows people with mobility impairments to engage in outdoor activities and tasks with greater ease (McCullagh, 2006; White, Paine-Andrews, Mathews, & Fawcett, 1995).

While ramps are increasingly an integral part of mobility support, installing a ramp can be costly and may pose a financial barrier for low-income persons (Dewey et al., 2004; Pynoos & Nishita, 2003). Ramps are among the more expensive adaptations because constructing ramps may involve structural alterations to the fabric of the building (Gitlin, Mann, Tomit, & Marcus, 2001). Apart from the installation costs, the theory of life cycle costing suggests that the disuse of ramps can involve significant disposal costs, such as demolition and scrapping (Woodward, 1997). As ramps have been traditionally designed as permanent fixtures, they may also fail to respond quickly to the changing needs of people with mobility impairments. This is because the need for ramps is often temporary and clients may subsequently move. Therefore, this occasional paper focuses on alternative types of ramps that would provide more cost-effective and adaptable solutions where a permanent ramp is neither desirable nor possible.

Traditionally ramps have been constructed for long-term use in materials such as concrete, steel, and timber. While steel and timber ramps can be relatively easily dismantled, demountable ramps are emerging as a more flexible option (Jung & Bridge, 2010). Literature suggests that they can be relatively easily relocated compared to permanent ramps, facilitating dismantling and then re-installation at another home (Duncan, 2004). Thus, demountable ramps have the potential to: provide more flexible and cost-effective home modification; support greater client independence and participation in their community; and assist carers and care workers in delivering care.

## Aims

There is growing recognition of the potential for the use of demountable ramps. However, a paucity of information exists regarding the use of demountable ramps in Australia, as they are a relatively under-explored option (Alam, 2003). For instance, there has been little published research on demountable ramps. Most information available about demountable ramps is anecdotal or provided for commercial purposes. Thus, a systematic compilation of information is required.

This research seeks to provide a comprehensive understanding of the current design, installation and use of demountable ramps. Through understanding the advantages and limitations of using demountable ramps, this research aims further to investigate the possibility of demountable ramps as a potential cost-saving home adaptation compared to other mobility access options. It is hoped that this research will increase consumer knowledge and assist consumers to make informed decisions when choosing a ramp. The research also seeks to guide home modification practice in supporting people with mobility impairments, with a greater focus on flexible design.

The key aims of this research are to explore:

**Features of demountable ramps:** What are the main design features of demountable ramps and how are they different from other types of ramps? What is the range of demountable ramps currently available for the homes of older people or people with a disability? Is the quality of design of demountable ramps desirable?

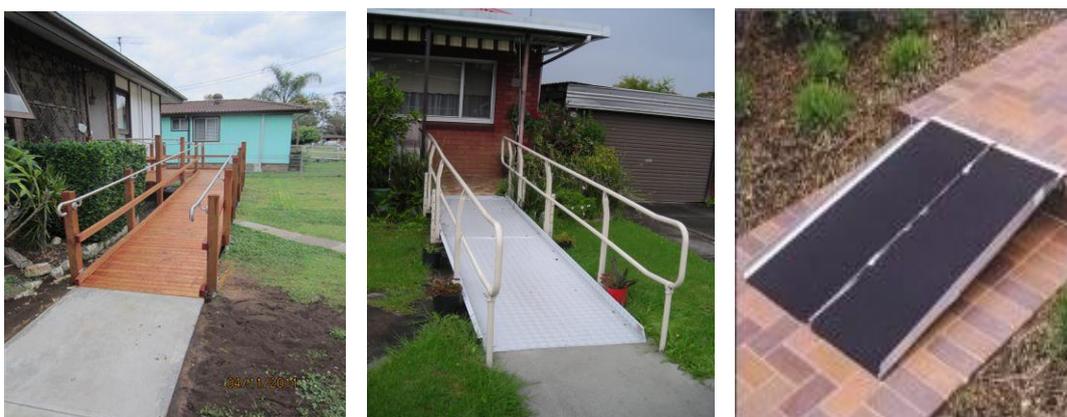
**Trends in demountable ramp demand:** What are the demographic characteristics of demountable ramp consumers? Are there changes in consumer preference or market demand for demountable ramps?

**Advantages and limitations:** What are the main advantages and disadvantages of demountable ramps compared with other types of ramps? How do people needing demountable ramps evaluate their demountable ramp?

**Policy support:** Do the currently available demountable ramps enable flexible, cost-effective home modifications for access? Does current government and program policy support the use of demountable ramps?

## Defining demountable ramps

There are basically three types of ramps depending on the level of their movability: permanent, demountable and portable (Belknap, 1997; Travers, 1991). Ramps are usually constructed as permanent fixtures. In general, permanent ramps are built using timber and/or concrete. Permanent ramps are structurally attached to the home, while portable ramps can be carried or transported. Demountable ramps are positioned between permanent and portable ramps. A demountable ramp is designed to be removed and relocated to another place. Thus, demountable ramps could also be categorised as semi-permanent ramps.



**Figure 1. Examples of permanent, demountable and portable ramps**

Although there is no agreed definition of demountable ramps, an essential design feature is that they are 'constructed in modular sections that can be connected as required to make up a ramp' (Alam, 2003, p. 17). For this reason, demountable ramps are often known as modular ramps. In demountable ramps, the ramp components, including platforms, landings, and handrails, are assembled with the use of bolts, clamps or other fittings (Belknap, 1997). In some cases, the movability and re-configurability of a demountable ramp may also allow its use for a portable purpose (Zackowitz, Vredenburgh, & Hedge, 2005). However, demountable ramps are different from portable ramps, as the former are usually physically attached to the client's home, although they are designed to be removable. In general, portable ramps do not require a construction process or engineering works for installation. Portable ramps can be folded, assembled/disassembled and carried, usually by one person. While some models of demountable ramps are portable, they are not designed to be used that way.

## Research design

This research was designed as a qualitative study for the following reasons. Firstly, the nature of the data of this study is qualitative, not numerical. The personal experiences, expert knowledge and detailed perspectives of relevant stakeholders provided the raw data for this study. Secondly, the numbers of potential participants in the study were small, and thus semi-structured interviews were seen as both feasible and appropriate. For example, the demountable ramp industry in New South Wales is dominated by only

a few suppliers, as verified by Google searches and databases searches such as the Independent Living Centre of New South Wales assistive technology database. Lastly, a qualitative research design using semi-structured individual interviews would facilitate: the probing of the meanings that interviewees give to their behaviour in selecting a ramp; ascertaining motives and intentions; giving informants the opportunity to check what is meant by a question; allowing for long and complex responses; and allowing for flexibility in the order of questions, the questions asked and the topics discussed.

The data collection process was guided by the protocol of the Built Environment Human Research Ethics Advisory Panel of the University of New South Wales. In particular, all the stakeholder interviews complied with the University of New South Wales Human Ethics protocol's principles of voluntary participation, informed consent, and confidentiality (see the Appendices attached at the end of this publication).

**Table 1. Sampling design**

Stakeholder strata	Intended populations	Final sample
Supplier	Ramp producer, dealer, and distributor	1
Installer	Ramp builder	3
Consumer	Ramp user and the carer	3
Access professional	Occupational therapist and access consultant	1
Funder in policy sector	Government department associated with policy and funding	2
<b>Total</b>		<b>10</b>

For both comprehensive and balanced data collection, this research has adopted a stratified sampling method, where, based on the shared characteristics of the participants, a population is divided into smaller strata to improve the representativeness of the sample. To encompass the range of people engaging with demountable ramps, this study categorised the key stakeholders into the following strata: suppliers, installers, access professionals, consumers, and funders. At least one or two samples were drawn from each stratum, and ten people were interviewed in total. Although it is assumed that the consumer cohort was the most numerous given it represents the largest group of potential participants, a limited number of consumer participants were included for balanced representation of diverse perspectives. Interview questions were based on the aims of this research above and adjusted for the characteristics of the individual participants.

## Major research outcomes

### General features of demountable ramps

There are variations in the design and features of demountable ramps, including materials and recyclability. Demountable ramps are made of various materials such as steel, aluminium, polyethylene or compressed fibrous cement. Most commonly, demountable ramps are made of aluminium. Some demountable ramps use steel or fibre-reinforced plastic for the path base.

One of the unique features of demountable ramps compare with other types of ramps is their removability and reusability. In most cases, all of the parts of the demountable ramps can be recycled at another site. However, the level of reusability may vary with each demountable ramp and its original installation requirements. For example, some demountable ramp supports may be concreted into the ground, and, in those cases, the demountable ramp could not be dismantled in its entirety. Although, the basic concept of the demountable ramp includes removability and recyclability, it is not uncommon that ramps are built using a combination of materials, and that not all components of the ramp are reusable and/or recyclable. Demountable ramps are generally constructed in modular sections as the following description suggests:

I suppose I call it demountable something that comes like a Meccano set and you can put it together, and it will sit there. And if you want to take it away, you can take it away.

Although demountable ramps are removable, they are designed for long-term use. Therefore, it should not be assumed that demountable ramps will be used only for a short-term period. However, demountable ramps are usually seen as an ideal type of access ramp in situations where mobility impairments are temporary or the tenancy/occupancy of the home is short-term or insecure. Therefore, ramp installers and suppliers provide consumers with options for the rental as well as purchase of demountable ramps. According to ramp installers, demountable ramps were currently more likely to be rented than purchased.

We use demountable ramps predominantly in a rental situation. If an old person might have a hip operation and for eight or ten weeks, we can provide a rental ramp, because the hip operation is going to get better. So we provide a rental ramp. When they get better, and when they can use the front steps, we take the ramp away. (Installer A).

There is no standardised process for the installation of demountable ramps. If the demountable ramp and its installation are funded by government sources, the same process is used as for permanent ramps. That is, the process of ramp installation is initiated through an occupational therapist's assessment of the client in their home and the resulting prescription. However, as demountable ramps are a prefabricated type of ramp, all the parts are ordered and delivered ready-made rather than being constructed on-site. To order demountable ramps, the suppliers are provided with a detailed site plan and proposed ramp design. Photographs of the site and location and a drawing of the plan with land measurements and elevations etc are sent to the suppliers. All the

parts are delivered to the installers with a tool kit and instructions, for the installers to assemble the ramp.

We just send those details to the supplier, and they will give us a quote. If we accept the quote, ..., then they send it up on the pallet. And all of the parts are in separate packets, and there is a little toolkit that comes with the screws in it and then you assemble it (Installer B).

The main installation task for a demountable ramp is that of connecting the ready-made parts to form the ramp. Therefore, quick installation is another feature of demountable ramps. Installation time varies among models of demountable ramps, and according to the site situation e.g. the required length and/or the need for a switchback system<sup>1</sup>. According to interview participants, the installation of demountable ramps does not take longer than three to four days. Some models can be installed in two to three hours. The short installation time was seen as an advantage, compared with permanent ramps. However, it should be noted that there could be a waiting time for the supplying of demountable ramps from the time of order to the actual installation. It may take three to four weeks from initial order date to the delivery date.

Quick, a lot quicker. Probably half of the time for installation or a quarter of the time for installation. It might be two to three hours to put the same ramp in for us (Supplier).

The life span of demountable ramps is difficult to standardise, as it is affected by various factors such as the characteristics of the user and the location of the ramp. However, industry participants believed that demountable ramps are designed to last as long as they are required. The durability of demountable ramps facilitated long term use for multiple times and in different locations. In general, Australian suppliers of demountable ramps provide a ten-year warranty.

## Trends in the usage of demountable ramps

This research has found that the industry for construction of demountable ramps is characterised by having a small number of suppliers. There are a very limited number of demountable ramps manufacturers operating in Australia and while some are Australian industries the majority are simply suppliers that import demountable ramp kits from overseas. According to the estimate of one demountable ramp supplier, timber ramps dominate ramp provision, accounting for 70% of the market, with concrete ramps also being a significant proportion of the market. Taking these statistics into consideration, demountable ramps seem to be a niche market. One access consultant who provides people with information about access solutions supported this. Another factor that restricts the market for demountable ramps was the availability of portable ramps, as the following remarks demonstrate:

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<sup>1</sup> A bend in a ramp with a very acute inner angle, making it necessary for a wheelchair to turn almost 180° to continue along the next segment of the ramp.

We usually deal with people that actually kind of build permanent ramps in their cottage or in their unit or whatever. Most of our inquiries are about permanent ramps. We don't seem to get too many inquiries about modular ones. What we get is that people want a permanent ramp or they want a portable ramp (Access Professional).

According to suppliers and funders of demountable ramps, they represent a more recent market innovation and are a relatively new option compared with other accessible entry products, they have only been provided in earnest to Australian people for about 5 years. This research has identified some factors that are contributing to the shift away from the traditional (permanent) ramps.

First, historically there have been potential consumers whose needs cannot be appropriately satisfied by permanent ramps i.e. clients with a short-term disability or consumers who have insecure housing accommodation. However there has also been a lack of provision of demountable ramps resulting in a mismatch between supply and demand. Secondly, although timber has been the dominant material for ramp construction, its limitations as a material have been clearly documented and include the decreasing availability of timber for ramps and the ongoing maintenance cost of treating it (Alam, 2003). Thus, ramp providers have been seeking a better material, and have identified the current types of demountable ramps as potentially meeting that need. Lastly, the potential long-term cost-effectiveness of demountable ramps has attracted attention from home modification funders. The following comments of an installer demonstrate recognition that timber ramps might not be a sustainable access solution.

We've got away from timber. We find that timber takes a lot of maintenance. It needs to be oiled each year, which is something that we won't do, and a lot of clients are too old to actually do it. And it is an on-going cost for them. And the timber that is available now isn't as good as it used to be. It warps and becomes trip hazard. And you have to go back and replace boards and the likes. We don't do timber at all anymore. ... It's just good timber became hard to get and we thought there has got to be a better way (Installer A).

Demountable ramps are a particular solution for ramping entry and egress routes and as such are systems for improving accessibility to and egress from a building entry. People with impairments of function such that they are unsafe or unable to manage stairs include not only wheelchair and electric scooter users but also a wide range of other disability types such as Parkinson's Disease, people using bilateral crutches or walking frames, and conditions that affect hip flexor muscles (e.g. multiple sclerosis, stroke, or arthritis). Consequently, there are no specified consumer groups that are targeted by the suppliers of demountable ramps, although people with spinal injuries, spasticity and older people are typically the primary beneficiaries. More importantly, demountable ramps are primarily seen as most beneficial for people with temporary mobility impairments, people in rental accommodation, and people with the intention of moving from their current accommodation. Demountable ramps were also seen as a short-term solution for difficult to modify environments, such as heritage listed buildings, exhibitions, medical facilities, and demountable buildings. The followings

interview quotes illustrate opinions about where demountable ramps are seen as the better solution:

Somebody has a short-term [disability]... two broken legs and they are in wheelchair, and their house has three steps at the front. They obviously can't get in and out. They need to have a ramp. We will put in a rental ramp as opposed to putting in a permanent fixture. ... You know their legs will get better. And they will be able to get up and down three steps after a period of time (Installer A).

Our products are very good for heritage buildings, where they can't fix a ramp, because they can't be drilling to a tile, or they can't attach it to sand stone. Our product sits on top of the step, so doesn't do any damage (Supplier).

The consumers would have to be people that are renting, you know, rental properties. They may want to put in ramps that can be removed, and a short-term ramp (Access Professional).

According to supplier and installer participants, the demand for demountable ramps is increasing and it seems that there are some locations where they perform better than permanent ramps. Parts of most modular ramp systems are pre-cut and pre-sized and there is no need to cut or drill anything to install them. In addition, this research has found that there are also some Home Modification Services that construct their own demountable ramping systems using 'off the shelf' parts, some of which are easily purchased at a local hardware store.

If the availability of suitable timber for ramp construction decreases, and demountable ramps can overcome the reported shortcomings of timber components, it is possible that the use of demountable ramps will increase further. However, at this time, it is uncertain that demountable ramps could replace their timber counterparts in all situations as demountable ramps have their own shortcomings. Supplier and installer participants' comments suggested that future demand for demountable ramps would largely vary with user preference and the specific environmental situations where demountable ramps are preferred. Despite market conditions that may indicate a need for a wider provision of demountable ramps, and their potential capacity to replace traditional, permanent ramps, demountable ramps are still not regarded as the best solution for long term use, as the following comments suggest:

It depends on the situation. If it's going to be there for the long term, I wouldn't recommend them, but for temporary ones I certainly suggest them. Sometimes I will go for them, but sometimes I won't. Somebody is going to die in the near future or if they are going to move, I can suggest them (Installer B).

## Advantages and limitations

### Advantages

Demountable ramps have greater flexibility of features when compared with other types of ramps. For instance, demountable ramps are, by their very nature, designed for easy removal and reuse. As has been acknowledged, constructing a ramp is one of the most complex and expensive home adaptations along with bathroom and kitchen modifications (Pynoos & Nishita, 2003). Thus reusable ramps could provide a cost-efficient solution for people who will eventually need to move the ramp to use at another site. In fact, consumers who intended to use the ramp at different locations over time were specifically choosing demountable ramps. Also demountable ramps were being prescribed for situations where the users expected to move. As was mentioned earlier, the reusability and flexibility of demountable ramps varies with each model. However, whilst not all demountable ramps are designed to be used multiple times, many can be easily relocated minimising 'abandoned elements' when clients relocate. The following example highlights the importance of ramp choice flexibility in some contexts:

We have done that recently where the lady was staying at a friend's place and then when she was able to look after herself, we took it down from that house, and we took it to her own house, and shortened it. In the end, we placed it there so that she could use it while she has the full recovery process which it will take another year (Installer B).

The flexibility inherent in demountable ramps stems to some extent from their modular nature in conjunction with the durability and low maintenance materials employed in their design and construction. For instance aluminium, the main material for most types of demountable ramps, is a durable and lightweight metal which supports quick installation. The construction period for ramps has multiple implications for consumers, not only cost, but also more immediate benefit. The increased speed of installation is directly related to a reduction in installation costs, in particular labour costs (Jung & Bridge, 2010). Timely intervention is a critical factor in home modifications, and the beneficial effects of home modification reduce when there is an increase in the waiting period before the installation (Pettersson, Kottorp, Bergström, & Lilja, 2009). Interview participants plainly articulated that demountable ramps have a clear advantage over other ramps in terms of installation period, because of the time saving involved with demountable ramps. According to one funder participant, rapid installation is one of the reasons that they prefer to fund demountable ramps.

It was much quicker, because sometimes our [clients] are very ill, and there is an urgency sometimes to get a ramp in particularly. And the demountable ramps could usually go in fairly quickly, quicker than someone like a local builder get in the timber ready to build up the ramp and install the ramp (Funder A).

The recyclability of demountable ramps also contributes to long term cost efficiency.

If a ramp is a permanent fixture, the disuse of the ramp involves high disposal costs, such as demolition and scrapping costs (Kumaran, Ong, Tan, & Nee, 2001; Woodward, 1997). As most elements of demountable ramps are re-used, demountable ramps can save these disuse costs when they are re-used. It is also possible that demountable ramps further reduce waste because the parts that are destroyed and replaced are minimal. Therefore demountable ramps were seen as an ideal option for funders that wish to reuse ramps for other clients (Alam, 2003). In fact, one government agency indicated that they were benefiting from funding the use of demountable ramps because of their recyclability:

We bought the components originally, so the cost of the next ramp where they are using that component would be cheaper because it's second hand. So what they (builders) have to ensure is that it's clean, and it's safe, and it's still of good standard, so it can go into the second and sometimes third [house] ramp (Funder A).

Reduced ongoing maintenance was identified as another advantage of demountable ramps. In general, the installation of ramps involves regular maintenance and after-care issues. In the event of break-down, or when replacement is required, maintenance may result in, not only maintenance costs, but also the temporary loss of functionality of the ramp with significant impact on the consumer. This research has identified that maintenance is not a significant issue for demountable ramps. Consumer and installer participants did not raise maintenance as an issue. Instead, the common experience and perspective was that demountable ramps, which were primarily metal, were superior to timber ramps in relation to maintenance. This is not to say that demountable ramps have no maintenance issues. According to one installer, demountable ramps need to be re-painted on the handrails and the surface, and the connection points of different parts may require maintenance. However, the following consumer experience is a reflection of the superiority of demountable ramps over permanent timber ramps in terms of maintenance and durability:

Down the bottom of the street, they had a ramp but it was a timber ramp and the husband had it. He had to have a ramp but later on he died and the ramp just went to rack and ruin. And they (funder) have put a ramp in for her. They've taken the wooden one away and pulled it down and they put in one like we've got out the front and it's just down the road from us. But it used to be a wooden ramp but it just rotten away. It got rotten so they pulled it down and put one of these (demountable ramps) (Consumer A).

Along with the benefits of quick installation and reduced maintenance, which originate from their flexible features, demountable ramps were also seen as an option that can minimise structural alterations to the home. There have been concerns that home adaptations for improving accessibility have the potential to reduce market appeal of the property (Duncan, 2004), although this is not always the case. It is not uncommon that ramps are no longer required, for example, when the user moves to an aged care facility or passes away. If structural adaptations such as ramps are unattractive looking, in poor repair or expensive to demolish, they may negatively affect the re-sale value of

a home. According to one installer, demountable ramps can be taken away without any visible sign that a ramp had once been installed. As demountable ramps can be installed without doing any significant damage to the property, they allow homeowners to avoid any negative effects on the home's potential market value resulting from perceptions regarding ramped entrances as ugly or less aesthetically pleasing.

We had another one set up at a man's place. He was very sick and he knew he was going to die and then they (family) were going to sell the house. So we used that one for a year or so and the man past away. So we took it away too (Installer B).

And the good thing is one of the final advantages is that in most circumstances the builders are putting these demountable ramps over the existing steps. So when the client dies, and the family want to sell the house whatever they need to do with the house, the ramp comes out and the steps are still there (Funder A).

This research has found that there is no significant functional difference between demountable ramps and other types of ramps. Like other ramps, demountable ramps were seen to perform their expected role of providing access and facilitating independence. Both installer and supplier participants believed that demountable ramps are safe when installed properly in compliance with the standards. Consumers were using demountable ramps with a sense of security and independence. Although demountable ramps may have some bounce, safety was not seen as compromised by the movement. Rather, because of the empty space underneath the slope of the ramp, demountable ramps were seen as not interfering with the building ventilation or damp course. The following is an example of the benefit from the space allowed by demountable ramps, which is not offered by, in particular, concrete ramps:

We've had some very heavy rain, so the waters been able to run down between the boards. Whereas if was cement, you could end up with it coming in the door. Seeing as it (the ramp) comes level with the door and you could have it coming, actually coming in and being a problem I think (Consumer C).

## Limitations

This research has identified widespread aesthetic issues around demountable ramps. Their appearance was one of the most commonly cited downsides of demountable ramps. In general, all ramps have raised aesthetic concerns because they occupy considerable space and are thus visible. Unattractive ramps have been discussed as a factor, which discourages home owners from accepting a ramp installation. Thus, ramps have been recommended to be constructed in a compatible style to the home so that they do not have negative impact on the appearance of a home (Duncan, 2004). Figure 2 illustrates the aesthetic difference that can be achieved between a permanent ramp in timber that is designed to match the home's design, and a demountable ramp for general use.



**Figure 2. Permanent timber ramp and demountable ramp in similar locations**

Although aesthetics is an issue for all types of ramps, demountable ramps were seen as raising the most serious aesthetic concerns. This may be because they are fabricated from industrial looking materials (such as checker plate metal sheets) that are inconsistent with the rest of the home facade, and can detract from an image of 'home'. According to Lewis (1986), the institutional appearance of ramps may have the side effect of threatening the self identity of residents and stigmatising occupants by signalling that they are different from their neighbours. This research has identified that resistance to the appearance of demountable ramps is common. Installer participants have strongly suggested that the temporary and institutional look of demountable ramp has a negative influence on consumer preference. One of them recommended that demountable ramps be placed at less visible places such as at the rear of the home.

They don't look like good. But we do give the option of demountable ramps for clients. Most people go away from that, and they go with the other ramping system that we have, which is more permanent one, when they need one (Installer A).

Clients don't like them. It's like any product. If it doesn't look nice, people don't really want to buy. ... People want to buy something that fits in [with] their house and looks nice. And demountable ramp doesn't meet that criterion (Installer C).

They aren't the sort of thing you would put out at the front of this building or another nice house. But around the back of the house they would be fine, out of the vision from the street. They've certainly got a place (Installer B).

Their inability to be customized was seen as another significant limitation of demountable ramps. As demountable ramps are prefabricated with modules of a certain length, it is possible that they could create inefficiency and require compromises. That is, they cannot be adapted to suit every situation, and the ramp may, for example, end up with a bigger landing than would otherwise be necessary. There were some differences of opinion among installers on this issue. Whilst one installer considered the customisation issue as the critical limitation of demountable

ramps, another installer found that there were not many situations that required customisation for the installation of a demountable ramp, and thus they could be installed in most situations.

Despite these differing views, it was generally agreed that the inability to customize them was a downside of demountable ramps.

Let's say that you want to put in a certain ramp with certain length to meet the correct gradient. You might not be able to make that length out of modular components available. So it might have to be longer than the space. So they would take up more space (Installer C).

The main downside of the ramp is the fact that it cannot be utilised at different angles. It is pretty well fixed at 90 degrees or 45 degrees, so they are not customised like timber ramps. If the walls are not straight, you can actually build a timber ramp to fit the wall (Supplier).

Response to climatic exposure was also presented as a potential weakness of demountable ramps. It has been recognised that durability and performance of outdoor ramps is influenced by climatic conditions such as temperature, the amount of precipitation, and the level of humidity (Jung & Bridge, 2010). While the influence of natural environments have typically been an issue for timber ramps (Alam, 2003), demountable ramps were also seen to be subject to the same external conditions, such as rain, ice and hot temperatures.

Susceptibility to the influence of natural environments was seen to increase the risk of some hazard factors, although geographical location and local weather conditions were not considered as significant factors that restricted the installation of demountable ramps. One supplier participant stressed that demountable ramps made of aluminium are anodised and thus anti-corrosive. According to that participant, demountable ramps were designed to be slip resistant and to withstand harsh weather conditions. In fact, this research has not identified any actual incidence of injury which occurred when using demountable ramps. However, many participants expressed a concern that demountable ramps could become slippery in frosty and icy conditions, hot in the heat, and corrosive in coastal areas. The following interview participants' comments express their concerns about metal ramps:

A lot of places can get really hot, and some places get really cold. So for instance, aluminium ramps down at the Snowy could create issues and then you've got also the issues of your fixings. And also in the heat, as well as probably you've got issues in expansion and contraction and how that will affect the joining mechanisms of the ramp. So they need to be considered. For the permanent concrete ramp, you are not going to have those problems (Access Professional).

Probably there are not many situations that they shouldn't be installed. But there are certain areas you probably wouldn't use them for a variety of reasons. For example, demountable ramp is a nearly [all] metal construction. So I wouldn't be putting it in Broken Hill where you've got very hot temperatures, only because the metals can get hard to touch (Installer C).

As presented previously, demountable ramps have some cost saving factors through quick installation and reduced maintenance. However, this research has found that demountable ramps have other cost factors that may offset those savings. One factor was the more expensive material costs of demountable ramps. Although there may be variations across different models of demountable ramps, the net material costs of demountable ramps were positioned between those of timber and concrete. To a supplier of demountable ramps, the price gap, compared with the timber ramps, posed a significant obstacle for the business, as the following comments suggest:

The cost of aluminium to timber is an issue. So it's never going to compete with the timber ramp's cost. That would be a problem. If price can be improved and then people may shift from timber to aluminium ramps (Supplier).

Other cost factors were related to customisation and storage issues. It is possible to assume a situation where the modular components of demountable ramps are not appropriate to construct a particular ramp. In this case, a special order needs to be placed, which might result in a longer construction period and a consequent increase in the installation cost. Storage was another factor that could compromise the long-term cost-effectiveness of demountable ramps. While reusability is a key potential benefit of demountable ramps, they could create storage and recycling costs, in particular, to individuals or organisations without sufficient storage to store the disassembled parts while awaiting reuse.

You can't change it, no. To customise it, if you wanted special piece, you would have to get onto the factory and they have to make it. So demountable ramp is like a Lego set. What you buy is what you get. If you want different piece, you will have to make it yourself, or get the company to specially make it. And then that becomes expensive (Installer A).

If the individual no longer needs it for, instance, we would have nowhere to store, keep, and maintain the demountable ramps. So it would be a burden for us to take things back. So I think even though demountable ramps could be reused, if it is not appropriate, we've got nowhere to store them, so in the long run, it may not be as cost-effective for us to have that benefit that demountable ramps provide (Funder B).

## Policy supports

As installing a ramp is an expensive home adaptation, the availability of financial assistance from governments plays a critical role in the provision of ramps, and consumers' access to and decisions about them. There are many government agencies, and their funded organisations, in New South Wales that fund or commission the installation of ramps. Their clients cover the full range of mobility impairments, including those caused through ageing, lifelong disability, traffic accidents and so forth. This research has found that, although each agency applies different criteria in selecting eligible persons for funding, none of them have any guidelines that promote any specific type of ramp, but rather it is left to the discretion of the prescriber, usually an occupational therapist. In principle, these agencies fund the ramp that best meets the need of the client. The normal process of ramp provision is based on an occupational therapist's assessment and prescription. The client is involved in the process of assessment with the occupational therapist and in consultation with the builder/tradesmen.

So we have occupational therapists that do the assessment for us, specialising in home modification. They make the recommendations. All we do is we approve the funding (Funder B).

We get the referral from the occupational therapists and a home visit of the OT. We talk about where it's going to go, which is the best way, what the ramp will be made of. The clients are involved in those discussions, and then we go through the home modification process of negotiating a contribution from the client (Installer A).

Despite the limitations of home modification program budgets, government agencies may not set a limit on the amount of funding for an individual home modification such as an access ramp depending on the assessment criteria and whether or not subsidy is or is not means tested. According to funder participants, the key goal of funding was to meet consumer need, not to choose the most cost saving option. The agencies saw themselves as providing financial supports for eligible persons without restricting their choice of ramp. However, they were concerned to ensure that the process of ramp provision met any legislative requirements, such as Building Codes, and that the people involved in the ramp installation are qualified and have sufficient training and knowledge.

There is no cost limit... It's actually called beneficial legislation, because the government is committed to assisting all of the eligible people stay in their homes as long as it's safe and that they can continue to functionally achieve staying at home. So the government will do as much as required to keep them at home (Funder A).

We don't necessarily always go for the cheapest. We go for whatever best meets needs about people in the scheme (Funder B).

The amount of funding available for ramp installations varied with each agency. However, all the ramp users that participated in this research received financial

assistance from a government agency to install their ramp, and they expressed satisfaction with and appreciation of the level of government support available.

Demountable ramps were assessed by the suppliers and home modification services who installed them as performing their expected function and this research has not identified any significant problems experienced by demountable ramp users.

Demountable ramp users were content with the benefits gained through the installation of ramps, such as improved independence and security. One interesting observation was that ramp users did not identify any aesthetic concerns with demountable ramps. In fact, one user participant demonstrated the benefit of the visibility of the ramp. The following comments indicate users' satisfaction with their ramps:

There's nothing I'm not happy with. I'm very happy it suits me fine. It's what I needed and I got what I needed (Consumer B).

I haven't found anything wrong with it. I enjoy it each time I go out. I enjoy it and feel happy with it... I'm just happy with it and thankful for it, too (Consumer C).

No, we don't have any problem using a ramp. It's been very good from the time they've put in. It's been better still since they put the ramp in the front door. Very good... It doesn't look out of place. If I pull up in a taxi, I say the house with the ramp. No, it's very good (Consumer A).

Ramp users had a good understanding of their ramps. They were aware that the ramps were for a temporary period and would be taken away when no longer required. Another important observation at this point was that user satisfaction was not compromised by the removability of the ramps. This research found that users believed that the recyclability of demountable ramps leads to cost-savings for the government. Removability of demountable ramps was also perceived as advantageous to families that did not intend to retain the ramps.

I know they can pull it to pieces and reassemble it somewhere else and that would save the government a lot of money too (Consumer A).

It will either be a case of I have died or I have gone into a nursing home, which it would be a case for the family to decide what will be done with it. I'd imagine they would want it removed (Consumer C).

So the family is usually very happy to have the demountable ramp, because they know that when mum and dad can no longer live with them, the ramp can go, and also can be used by another person (Funder A).

As was mentioned previously, cost-saving was not their primary criterion of funders, prescribers or installers when choosing a ramp option for their clients. That is, the most important principle of ramp funding was choosing a ramp that best met the consumer's needs. However, economic efficiency was not entirely ignored, and there were some other factors that were considered in making the decision, including consumer choice. Sometimes, the financial decision of the funding agency conflicted with consumer preference. For instance, a consumer may prefer a more expensive option to a more economical option as prescribed by the occupational therapist. To cope with these

differing world views and to incorporate consumer choice into their financial decision making, one funding agency interviewed had a flexible funding strategy as described below:

If, for example, the permanent ramp, the timber ramp, was more expensive, than the demountable ramp, we say to our clients if you want to pay the extra, because we will always look at what is the most functional and economical option. So for example the demountable ramp is cheaper because they have lots of recyclable component units, so the cost of the ramp is much cheaper than the comparative timber ramp, we would say to the family if you really want timber. We will discuss so that they pay the difference (Funder A).

## Implications for practice and future research

### Implications for practice

Flexible ramp design is a housing retrofit solution that results from a failure to achieve more wide scale inclusive housing design outcomes (Barnes & Design in Caring Environments Study Group, 2002; Ministry of Housing and Local Government, 1961; Sim, 1993). Flexible housing design refers to housing that is designed to adjust to the changing needs of the residents over their lifetime. The benefits of flexible housing have well been presented. Firstly, openness to change and variation incorporates future-proofing design features that enable cheaper, simpler adaptations to be made when needed (Nissim, 2008). Secondly, flexible housing increases the ability to react quickly to changing needs through readiness for adaptation (Nielsen & Ambrose, 1999). Thirdly, long-term economic affordability is one of the motivations for developing flexible housing, as flexible housing allows the upgrading of individual housing elements with minimal disruption to the entirety of a home, rather than costly structural alterations (Buys, Barnett, Miller, & Bailey, 2005; Kelly, 2001; Nissim, 2008). Although incorporating flexible design features may create an additional cost factor, the additional cost for flexible design does not account for a significant proportion of the overall construction cost (Bringolf, 2005). Fourthly, flexible housing supports sustainability (Crabtree, 2006). Lastly, environmentally sustainable homes require designs that are more durable, energy efficient, less wasteful material resources, and longer-lasting (Koebel, 1999).

Acknowledging that home adaptations capable of easy follow-up adjustments are both responsive and economical, this research believes that home adaptations also should be aligned with flexible housing design. The concept of housing flexibility is not a new approach. For instance, discussion on flexible housing traces back to early 20th century in the United Kingdom (Milner & Madigan, 2004). In Australia, policy emphasis on 'ageing in place' since the 1980s has provided contextual backgrounds for flexible residential housing design (Aged & Community Services Australia, 2005). Despite a long history of support for the concept of flexibility, it has never been fully accepted in housing design (Schneider & Till, 2005) and there has not been national framework to coordinate flexible delivery of housing in Australia (Saugeres, 2011). Although Australia

has developed the Standard on Adaptable Housing – AS 4299 since 1995 - the Standard is neither appropriate as a housing standard to meet the changing needs of residents across life span, nor enforced for private dwellings in general (Disability Council of NSW, 2005). As a consequence, flexible housing design is solely a decision for the owner of the home (Aged & Community Services Australia, 2005). More importantly, as flexibility is not considered at the home construction stage, it cannot be assumed that it has been incorporated into the modification stage either. This is to say, that there is typically often a lack of design consideration in planning home modifications with flexibility as a goal.

This research has found that demountable ramps have essential qualities to support flexible home modification. They are designed to support easy removal and reuse. Most components of them can be recycled at another site, which promotes low disuse costs. Their short installation period enables greater responsiveness to client mobility needs and facilitates timely intervention. Although they are perceived as an ideal solution for short-term use, they are designed to last as long as permanent ramps with little maintenance. Demountable ramps can be reused multiple times without compromising their durability, safety, and functionality. The reusability of demountable ramps also supports sustainable home adaptation. Compared with permanent ramps, demountable ramps produce fewer destroyed or abandoned elements. They can also be a solution for the decreasing availability of suitable timber for ramps. Figure 3 shows the qualities of demountable ramps that influence their choice for a home modification solution.



**Figure 3. Qualities of demountable ramp for flexible home modification**

However, despite all the potential benefits, the uptake of demountable ramps has been limited to a small group of people in very specific situations. From the interviews conducted for this paper, demountable ramps are considered as the solution for people with temporary mobility impairments, people in rental accommodation, and people

intending to move house in the foreseeable future. There were also intrinsic and extrinsic factors that limited the use of demountable ramps. Intrinsic factors included high material costs, limited capacity for customisation and consumer resistance to their institutional appearance. Extrinsic factors cited were aesthetics and land area available.

Nevertheless, from accounts of many participants in ramp practice, the potential of demountable ramps remains unclear as evident in the interview quotes below.

In a practical sense, I don't see any benefits of demountable ramps. I think there are more downsides than there are upsides (Installer C).

I think there is much of muchness... I think there is 'horses for courses'. There are different things to suit different areas (Installer A).

It seems that the wider introduction of demountable ramps into home modification practice is unlikely without addressing the intrinsic technical issues identified above. Clearly, the recyclability for demountable ramps was providing long-term cost effectiveness to funding agencies. However, they were not highly recommended for a long-term use for those individuals who intended purchasing their own ramp. In fact, the funding agencies were primarily providing demountable ramps in rental accommodation. Although funded ramps in general result in high consumer satisfaction, this research found that the funding process could also cause delay in ramp provision. For example, for one consumer, the installation of a ramp took five months from application. When considering the importance of timely intervention, this long waiting period not only causes frustration to the consumer with a disability, their family and care-workers, but also neutralises any benefit from responsiveness to mobility needs that would arise from a more rapid installation.

## Implications for future research

This research was designed to provide a baseline understanding of the advantages and disadvantages of demountable ramps from the perspective of a range of interviewed participants with experience of demountable ramps. Therefore the information presented in this research is a descriptive compilation of the current evidence supplemented by interviews with a range of stakeholders. However, this research is believed to have made a contribution to consumer knowledge. Also, as initial exploratory research on demountable ramps, this research has identified some important topics that require further investigation. The opinions of the participants on demountable ramps were fairly consistent. However, the status of existing information about demountable ramps can be characterised as unproven assertions based on theoretical assumptions, anecdotal experience, and/or hypotheses. This is seen as resulting from the short history of the use of demountable ramps in Australia. For instance, the cost-effectiveness of demountable ramps is clearly under-explored, remains theoretical and largely based on unproven assumptions about their recyclability which do not take account of storage and transport costs. Although this research has gained some insight about an emerging trend of initial cost saving from

the experiences of one funding agency, which has been providing demountable ramps for about five years, evidence of the long-term economic advantages of demountable ramps has not yet been produced. According to the interview participants, the installation of demountable ramps requires an expensive up front purchase cost. Thus the cost recovery period is an area that requires urgent investigation; the assessment of cost-effectiveness should also include the costs involved in the recycling process, disassembly, storage, transport, relocation and reassembly, including any necessary adjustments.

It is apparent that lack of evidence leads to a lack of awareness, insufficient consumer knowledge, and subsequent uncertainty in decision-making by consumers, prescribers, funding agencies and policy makers. Acknowledging that the use of demountable ramps is at an early stage, research on demountable ramps should start with the collection of basic information. For instance, there is no aggregated data on the numbers of demountable ramps installed, and indeed there is no evidence that all funding agencies collect these data. Also there is no data that demonstrates the flexible use of demountable ramps, such as the frequency of recycling of a demountable ramp by a single user, or by multiple users. This lack of basic data makes it difficult to estimate the market size and quantify trends in the use of demountable ramps.

Consumer evaluation is another essential element that can guide policy development and implementation. In this research, only a limited number of consumers were included albeit it with balanced representation of diverse perspectives. It is assumed that there are many types of demountable ramp consumer cohorts which could be distinguished by demographic differences, disability types, and whether their ramp is subsidised by government or not. There may also be variation in consumer preference and satisfaction with different types of ramps, depending on individual consumer characteristics. Therefore, it is further suggested that any investigation of demountable ramps should be accompanied by a comparison with other types of ramps. This would be expected to facilitate the establishment of best practice that could be tailored for specific consumer groups.

## Conclusion

Installing ramps has been a longstanding practice in home modification, and there is a wide range of ramps available on the market, including several models of demountable ramps. While this variety increases consumer options, consumers are uncertain about which ramp best satisfies their access needs within their, and/or their funding agency's, budget. In particular, it is assumed that consumers have relatively less information about demountable ramps, as they are a newer option than other types of ramps. This research aimed to develop a better understanding of demountable ramps, and therefore focussed on the design features, advantages, limitations and policy supports for the use of demountable ramps.

Based on the accounts of interview participants, this research has found that demountable ramps can provide an alternative ramping system for improving

accessibility of the entry to the home. The reusability and recyclability of demountable ramps have the potential to facilitate flexible, timely, cost-efficient and sustainable home modifications. However, the relatively high up-front cost and institutional appearance of demountable ramps is preventing many stakeholders from choosing this type of ramp. Demountable ramps were largely perceived as a temporary option for short-term use, and thus for hire rather than purchase.

This baseline research on demountable ramps has found significant implications for ramp practice and identified areas for future research. Demountable ramps clearly have essential qualities that respond to an increasing emphasis on flexibility and sustainability in community care settings. Interviews with funding agencies suggested that there were no constraints in the policy regarding the use of demountable ramps.

Thus, an increase in the use of demountable ramps was largely seen as depending on the manufacturers' and suppliers' capacity to improve the aesthetics and potential for customisation. Due to the short history of the use of demountable ramps in Australia, there has been limited information about their features and benefits available to date. Anecdotal, rather than evidence based, information has been all that was available; and many aspects of demountable ramps are still open for further investigation. Therefore, the development of evidence that can support best practice is highly suggested.

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## Appendix 1: Invitation to Participate



BUILT ENVIRONMENT

[Date]

[Name of the organisation]

[Address]

### Invitation to Participate in Research

#### **Title: Demountable ramps: A qualitative assessment of value for people with mobility impairments**

Dear sir/madam

The Home Modification Information Clearinghouse is trying to understand all the advantages and limitations of using demountable ramps, also known as modular ramps, as a solution for enabling home access. This project aims to explore demountable ramps including their design features, market trends, consumer evaluation and policy implications.

[Name of the organisation] has been identified as one of the key informants relevant to demountable ramps. I am seeking support from your organisation to assist in this research. It would be greatly appreciated if you or a delegate of your organisation would be prepared to participate in a semi-structured interview. Interview will take no longer than one hour. An information statement will be provided to the participant and the participant will be required to provide written consent for audio-recording of the interview and photographs of ramps prior to the interview.

While we do not guarantee any direct benefit, your participation is important in building our knowledge of the products and their impacts on the lives of people with mobility impairments.

If you have any questions or require further details of this research, please do not hesitate to contact Yong Moon Jung (telephone: 02 9385 6252, email: [y.jung@unsw.edu.au](mailto:y.jung@unsw.edu.au)) or Associate Professor Catherine Bridge (telephone: 02 9385 5357, email: [c.bridge@unsw.edu.au](mailto:c.bridge@unsw.edu.au)).

Yours sincerely

Yong Moon Jung & Catherine Bridge

Home Modification Information Clearinghouse, City Futures,  
Faculty of the Built Environment, University of New South Wales

## Appendix 2: Information Statements

### PROJECT INFORMATION STATEMENT

Date: 10 October 2011

**Project Title:** Demountable ramps: A qualitative assessment of value for people with mobility impairments

Approval No.: 115126



BUILT ENVIRONMENT

#### Participant selection and purpose of study

You are invited to participate in a study that explores the advantages and limitations of using demountable ramps as a built environment access solution. This study is designed to better inform Home Maintenance and Modification Services and Consumers about effective solutions and is funded by the Home and Community Care Program. It aims to investigate the design features of demountable ramps, that is, what makes them useful and or causes problems with their deployment. We will be talking to manufacturers, suppliers, installers, supporting professionals, consumer organisations, and government funders so as to better understand the range and type of products available; the criteria for allocating and recommending them and any trend data about their usage. You were selected as a possible participant in this study because your organisation has been identified as having knowledge, experience and an understanding of demountable ramp sales, prescription, purchase and/or deployment.

#### Description of study

If you decide to participate in a one-off semi-structured interview, we will ask you a range of questions about your experience and ideas about demountable ramps. A digital voice recorder will be used to audio record the interview. It should take no longer than one hour to complete the interview. If you are willing to participate, we will come to you at a time and venue of your choosing; alternatively a telephone interview could be arranged. For the purpose of illustration in the report, photo-taking may be requested of any demountable ramps that best illustrate any of the advantages or limitations you share. We cannot and do not guarantee or promise that you will receive any benefits from this study. However, your participation is important in generating knowledge about demountable ramp products so as to improve policy and provide the best evidence to consumers, Home Maintenance and Modification Services and therapists.

#### Confidentiality and disclosure of information

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission, or except as required by law. If you give us your permission, we plan to use the raw data and photographs obtained from you to write a report about what works and what doesn't. This report will freely available online on the website of the Home Modification Information Clearinghouse ([www.homemods.info](http://www.homemods.info)). It may be also published in journals and presented at conferences. In any publication, information will be provided in such a



## Appendix 3: Project Consent Form

### PROJECT CONSENT FORM



**Project Title:** Demountable ramps: A qualitative assessment of value for people with mobility impairments

BUILT ENVIRONMENT

You are making a decision whether or not to participate in a research project.

This PROJECT CONSENT FORM enables you to indicate your preparedness to participate in the project. By signing this form, your signature indicates that you have decided to participate.

You will be given a PROJECT INFORMATION STATEMENT that explains the project in detail, and that statement includes a revocation clause for you to use if you decide to withdraw your consent at some later stage. The PROJECT INFORMATION STATEMENT is your record of participation in the project.

This PROJECT CONSENT FORM will be retained by the researcher as evidence of your agreement to participate in this project.

Please complete the information in this box.

Please indicate which of the following options you agree to by ticking one of the following options:

- I consent to being quoted and identified
  
- I do not want to be quoted or identified but am prepared to participate anonymously

.....  
Signature of Research Participant

.....  
Please PRINT name

.....  
Date

Name of researcher: Associate Professor Catherine Bridge

## Appendix 4: Photograph Release Consent Form

### PHOTOGRAPH RELEASE CONSENT FORM



**Title:** Demountable ramps:

A qualitative assessment of value for people with mobility impairments

BUILT ENVIRONMENT

#### Information statements

1. This research requires photographs for the illustration and usage of demountable ramps. It has been explained to me that photographs may be taken as part of research, and that they may be used for the purpose of illustration in the research documents associated with this research.
2. I understand that my likeness where it illustrates a benefit/failure of the demountable ramps in photographs may be available in publications relating to this project and on the website of the Home Modification Information Clearinghouse ([www.homemods.info](http://www.homemods.info)), and that they may be used in other research activities such as publication in journals and conference presentations.
3. I understand that no person in any photograph taken for use within this project will be able to be identified visually by facial recognition or by name in any photographs used (unless I request otherwise), and that no personally identifying material will be stored or used in any publication(s) coming out of this research.
4. I understand that I am not obliged to give my consent, but that once I do this release is irrevocable.

#### Participant's Permission and Rights Granted

By signing this release, I hereby grant full permission to the University of New South Wales to use, reproduce and disclose photograph of my likeness and ramp products with surrounding built environments in any publication of this research without payment or any other consideration.

This consent also serves to waive all rights of privacy and compensation, which I may have in connection with the use of the photographs. I understand and agree that images in photographs will become the property of the University of New South Wales. I hereby irrevocably authorise the University of New South Wales to edit, copy, exhibit, publish or distribute this photo for the purposes of research.

I agree that I have no rights to the images, and all rights to the images belong to the University of New South Wales. I waive the right to inspect or approve the finished product, including written or electronic copy, wherein my likeness appears. I will make no monetary or other claim against the University of New South Wales for the use of the photographs.

I have read this release before signing below and I fully understand the contents, meaning, and impact of this release.

.....  
Signature

.....  
Please PRINT name

.....  
Date